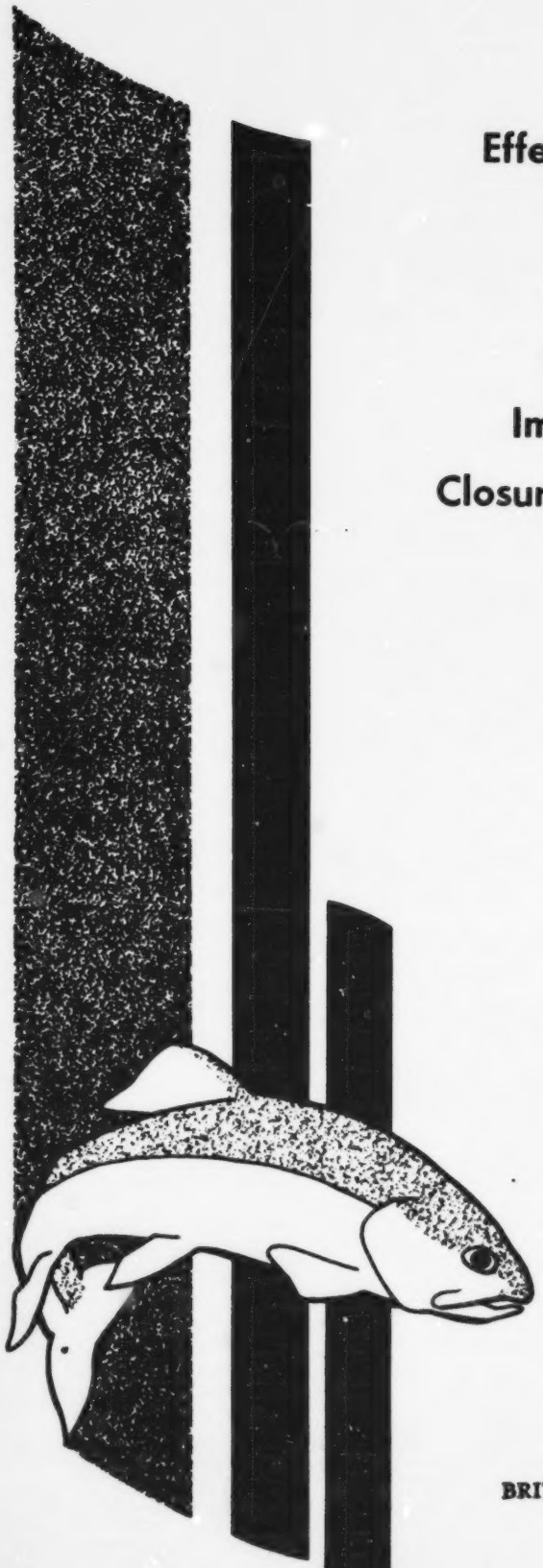

Effects of a 2.5 Year Closure of the Cutthroat Fishery on the Upper St. Mary River: Management Implications of Implementing an Alternate Year Closure on East Kootenay Trout Streams

by

A. D. Martin

J. M. Bell

Province of British Columbia
Ministry of Environment

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Fisheries Technical Circulars frequently contain preliminary data, and conclusions based on these may be subject to change. Reports may be cited in publications but their manuscript status (M.S.) should be noted.

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EFFECTS OF A 2.5 YEAR CLOSURE OF THE CUTTHROAT FISHERY ON THE UPPER ST. MARY RIVER: MANAGEMENT IMPLICATIONS OF IMPLEMENTING AN ALTERNATE YEAR CLOSURE ON EAST KOOTENAY TROUT STREAMS

by

A. D. MARTIN[1]

J. M. BELL[1]

[1]Ministry of Environment, Fisheries Branch, 106-5th Avenue South, Cranbrook, British Columbia, V1C 2G2

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ABSTRACT

Martin, A. D. and J. M. Bell. Effects of a 2.5 year closure of the cutthroat fishery on the Upper St. Mary River: Management implications of implementing an alternate year closure on East Kootenay trout streams. 1984. Fisheries Management Report No. 82, 17 p.

A creel census was conducted in 1979 and 1982 on the Upper St. Mary River in southeastern British Columbia to examine angler effort, and catch distribution within one watershed, and to analyze the size and age structure of cutthroat trout prior to and following a 2.5 year angling closure.

In July and August 1979 prior to the closure, total effort for the two months was estimated at 5000 angler hours resulting in a harvest of 4000 fish (0.71 fish/hr). Catch composition was 96% cutthroat trout, 2% Dolly Varden, and 2% mountain whitefish. Following the re-opening of the fishery on August 31, 1982, in September and October, total effort for the two months was estimated at 2170 angler hours to harvest 1710 fish (0.79 fish/hr). Catch composition was 79% cutthroat, 13% Dolly Varden and 8% whitefish. Catch success rates and the proportion of the catch released before and after the closure were similar. However, the spatial distribution of anglers and catch within the watershed and the size and age composition of cutthroat trout in the catch changed substantially. Mean size in 1979 was 23 cm compared to 29 cm in 1982 and mean age was 2+ in 1979 but 3+ in 1982. Prior to the closure, anglers concentrated on the more accessible reaches of the upper tributaries. Following the closure the distribution of anglers shifted back to the mainstem in response to increased fish abundance and size. Similar catch success rates before and after the closure were attributed to seasonal variability between the two census periods.

The 2.5 year closure on the St. Mary River watershed was effective in increasing the size and age distribution of cutthroat. These gains were transitory in association with liberal regulations. The results of a tag recovery study suggested that the stream could be "fished out" rapidly under regulations of 4 fish/day with no size limits, and therefore alternate year closures are not recommended for management of East Kootenay trout streams.

As a result of high levels of angler effort, future regulations on the St. Mary River should be designed to maintain quality stream fisheries by encouraging "limited kill" fisheries. The application of size limits, gear restrictions, reduced quotas and seasons are recommended on a stream specific basis.

ACKNOWLEDGEMENTS

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INTRODUCTION

The Upper St. Mary River in southeastern British Columbia has historically supported a popular fishery for Westslope cutthroat trout (Salmo clarki lewisi). Resident Dolly Varden (Salvelinus confluentus) and mountain whitefish (Prosopium williamsoni) were also caught in the fishery which occurred from mid-summer to early fall. Angling on the St. Mary River traditionally was concentrated on the mainstem St. Mary River and lower reaches of the major tributaries. However, with the expansion of forest development roads in the late 1960's to mid-1970's, fishing pressure increased substantially and shifted to the middle and upper reaches of the tributaries. Under a daily catch quota of 8 trout per day (16 possession), anglers reported the size of the cutthroat was small and success had seriously declined in the mainstem river fishery coincidental with increasing angler use. Also, fishermen reported the need to travel further up the tributaries to be successful.

In 1980, a complete angling closure was implemented on the entire watershed upstream of St. Mary Lake. The fishery remained closed for a period of 2.5 years prior to reopening on August 31, 1982. The objectives of setting a late season opening were to both provide residents with the initial opportunity to fish, and to reduce congestion on the river caused by a summer "opening day phenomenon". Limits for cutthroat in all streams in the Kootenays were reduced prior to the opening in 1982 to four daily, four possession. No size or gear restrictions were in effect.

In September and October 1982, the Fish and Wildlife Branch and the Ministry of Forests jointly initiated a survey to monitor recreational use in the St. Mary valley upstream of St. Mary Lake. A creel census was undertaken in conjunction with the recreational use survey to evaluate a management strategy of rotational (alternate years) closures (Radford, 1975 MS) for this system as well as other cutthroat trout streams in the East Kootenays.

The primary objective of this study was to examine the management implications of catch statistics collected immediately prior to and following a 2.5 year closure. A secondary purpose was to compare the fisheries use of the St. Mary watershed with other recreational uses.

Study Area

The St. Mary River originates in the Purcell Mountains of southeastern British Columbia and flows in a southeasterly direction entering the Kootenay River near Fort Steele. The river is fed by several major tributaries including Dewar, White, Redding and Meachen creeks which join the mainstem river above St. Mary Lake. The lake is located approximately 21.0 km west of Kimberley (Fig. 1). The watershed is subject to seasonal

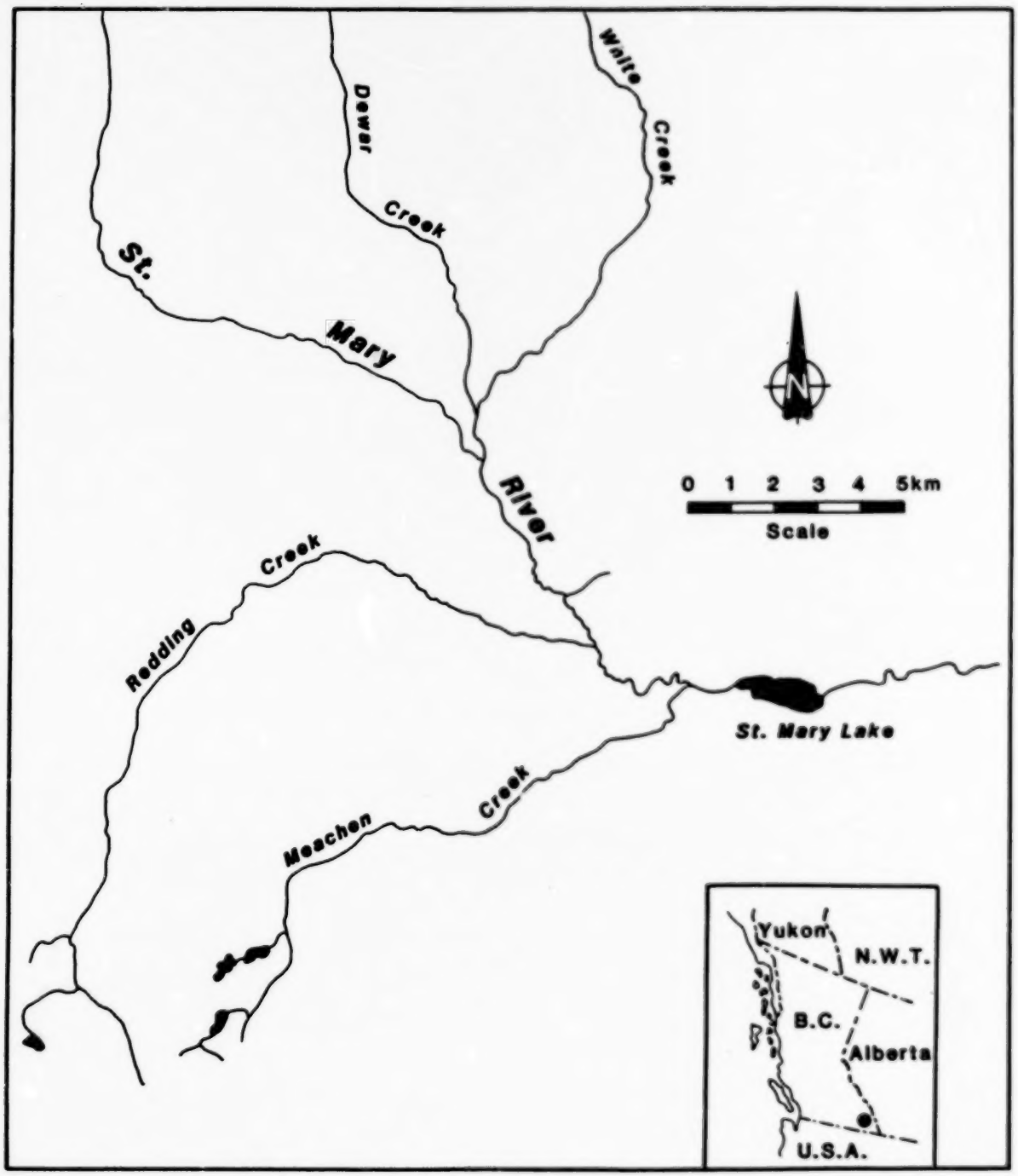

Fig. 1. Upper St. Mary River and tributaries.

variations in flow, typical of the interior of British Columbia. Maximum discharges generally occur in late spring-early summer with low flows in late fall and winter (Fig. 2). Levels of dissolved solids and nutrients suggest the river is of low productivity (Table 1).

Table 1. Selected physical and chemical parameters from the St. Mary River measured upstream of Marysville. Mean values for July to August (Ministry of Environment 1984).

	TDS mg/l	Specific Conductivity umho/cm	Ortho Phosphate mg/l	Nitrate Nitrogen mg/l
Mean	32.4	56.9	< .003	.033
1 S. Dev	4.2	13.5	-	.012
n	10	8	10	10

A network of forest development roads provide vehicular access into the upper reaches of the mainstem St. Mary River as well as Dewar, Meachen and Redding creeks. In addition, access into the Redding Creek drainage is supplied by a four-wheel drive road, referred to as the Gray Creek Pass. This route follows a power transmission line from kilometer 19 on the main Redding Creek road to Gray Creek on the east shore of Kootenay Lake. An upgraded fire control road provides two wheel drive vehicle access into the headwaters of White Creek and the St. Mary Alpine Park.

METHODS

In 1982, the recreational survey and creel census was carried out six days per month. Check days were stratified into four classes to account for day of week variation in recreational effort. One Saturday, one Sunday, three weekdays and one Monday were selected in advance using a table of random numbers. In 1979, only a creel census was conducted by the same methods.

A check station was immediately above St. Mary Lake on the main St. Mary River road to provide coverage of virtually every vehicle leaving the valley (Fig. 1). The station was generally occupied by one census clerk and operated from approximately 10:30 hr until nightfall. Information was collected from the occupants of each vehicle and recorded on a survey form (Appendix I).

One hundred percent coverage (ie. all anglers for a total day) was sought but was rarely achieved. Coverage was estimated to be 70% efficient and data expanded to provide a total daily estimate of fishing effort and catch (harvest and release). Since each census day was a sample representing a particular day class within a one month period, the estimated monthly figures for each day class were obtained by multiplying the census day figures by the number of days of the class in each month (Appendix II).

Anglers' catch were examined to measure fork length of the cutthroat trout and to collect scale samples. Scales were aged independently by at least two readers using a dual lens microfiche projector (magnification 36X). Fish were aged by counting the number of annuli on the posterior radius of the scales. Distances from the focus to successive annuli were measured. Back calculation of fork length was carried out using an Apple II+ computer (Apple Computers Inc., Cupertino, California) and DISCBAL Computer Program (Frie 1982).

Prior to the September 1 opening of the fishery, 35 cutthroat trout were angled using single hooked barbless flies then tagged and released in the St. Mary River downstream from the confluence of Dewar and White creeks to St. Mary Lake. These fish (range 27.5 to 39 cm) were evenly distributed throughout the lower section of the river. Tags were inserted into the posterior base with injected Floy anchor tags according to the procedure described by Dell (1968). Tags were 32 mm long which included 20 mm of yellow tubing, and were individually numbered and identified "B. C. Fish and Wildlife Branch, Nelson, B. C.". The tag number, fish length and tag location were recorded prior to release. Tags were recovered mainly during the creel census.

RESULTS

Recreational Use

In September and October, 5370 people expended 6420 recreational days in the St. Mary watershed. Use was approximately twice as high in September (4164 days) compared to October (2255 days). Hunting, wood cutting, fishing, touring and berry picking were the most popular recreational pursuits (Fig. 3). Berry picking, fishing and touring were popular in early September, while hunting was conducted from mid-September to the end of the survey period (Appendix II). The majority of recreational use was concentrated on the lower part of the St. Mary, Meachen Creek, Dewar Creek and Redding Creek. The upper part of the St. Mary River and White Creek received low use (Table 2).

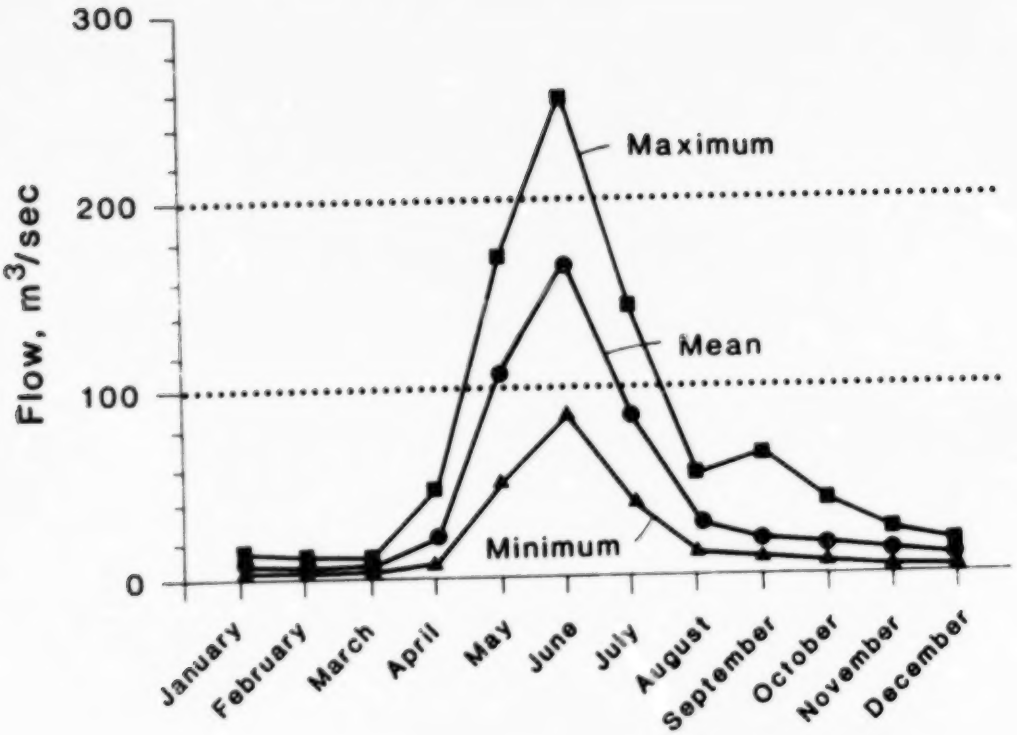

Fig. 2. Average and extreme mean monthly discharges of the St. Mary River near Marysville from 1946 to 1982 (Environment Canada 1983).

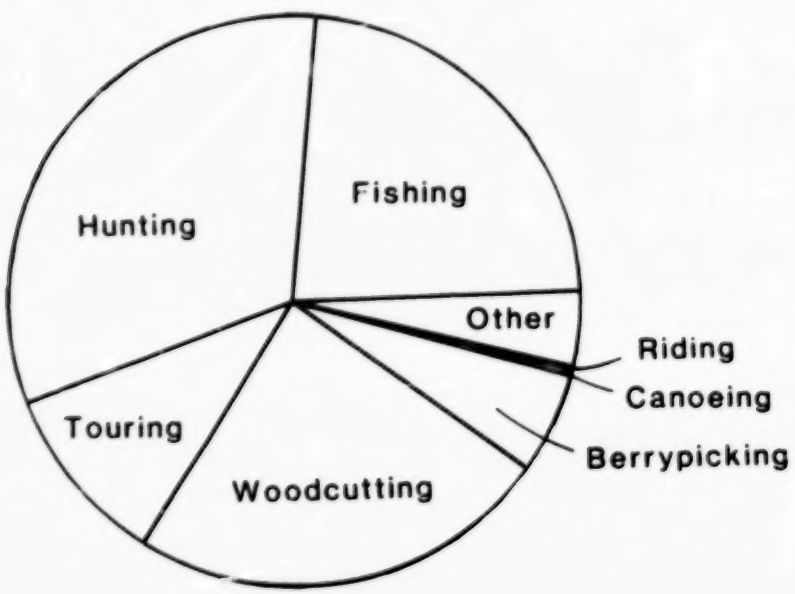

Fig. 3. Recreational use of the Upper St. Mary River watershed September to October, 1982. Percent by activity.

Table 2. Estimated vehicle use by drainage.

Drainage	n	%
Lower St. Mary	779	32.8
Upper St. Mary	217	9.1
Meachen Creek	417	17.5
Dewar Creek	421	17.7
White Creek	152	6.4
Redding Creek	392	16.5
TOTAL	2378	100.0

Resident status of recreationalists was comprised primarily of people from the East Kootenay area (79%). Persons from other parts of British Columbia comprised 19% of use while non-residents of British Columbia constituted 2% of use.

In July and August 1979, an estimated 1500 anglers fished 5500 angler hours and caught 4000 fish (Table 3). The species composition of the catch was 96% cutthroat, 2% Dolly Varden and 2% whitefish. Harvest per unit effort was .71 fish per hour and .69 for cutthroat. During the summer, anglers reported releasing 46% of the cutthroat they caught. Catch per unit effort for cutthroat trout was 1.3 fish per rod hour.

Table 3. Creel census statistics collected two months prior and two months following a 2.5 year angling closure of the upper St. Mary River.

	July-August 1979	September-October 1982
Anglers	1500	1220
Angler Hr.	5600	2170
Fish	4000	1710
CPUE	.71	.79
CPUE Cutthroat	.69	.62
Percent Cutthroat Released	46	41

In September and October 1982, an estimated 1220 anglers fished 2170 hours and harvested 1710 fish on the upper St. Mary River and its tributaries. The species composition of the catch was 79% cutthroat, 13% Dolly Varden and 8% whitefish. Harvest per unit effort for all species was .79 fish per rod hour and .62 for cutthroat. Anglers reported that they released 42% of the cutthroat they caught, therefore, catch per unit effort (killed and released) for cutthroat trout was approximately 1 fish per hour.

In 1982, anglers concentrated their effort on the mainstem St. Mary River (Fig. 4). More than 50% of effort and catch was centered on the mainstem with the remainder of effort and catch spread over the White, Dewar, Redding and Meachen tributaries. Prior to the angling closure on the system, the mainstem St. Mary River supported approximately 30% of the effort and catch, the remaining angling effort occurring on the tributary streams.

Size and Age of Catch

In 1982, the mean fork length of cutthroat caught was 29 cm and age 3+ years. Fish captured ranged from 13 to 42 cm in length and 1+ to 6+ years of age. Prior to the closure, cutthroat averaged 23 cm and age 2+ years. Size of fish captured ranged from 12.5 to 35 cm and from 1+ to 5+ years of age. (The few angled fish that were aged as 1+ or less were larger than expected, which may be caused by a failure of some trout to establish an annulus in year 1.) The proportion of larger, older fish captured after the closure increased significantly, compared to prior to the closure (Fig. 5).

Age and Growth

The Body (y) - Scale (x) regression for St. Mary River cutthroat trout was:

$$\text{Log } (y) = 1.55 + .761 \text{ Log } (x) \quad (r^2 = .75, n = 85)$$

Samples of cutthroat trout caught prior to and following the closure were pooled. Lengths (Li), were back calculated from scale measurements to each annulus (Si), as follows:

$$Li = a + (Lc - a) \times (Si/Sc)$$

where Sc = Scale measurement to edge of scale
Lc = Length of fish at capture
a = Intercept of the body scale regression

Back calculation of lengths of St. Mary River cutthroat indicated that on average they were adding about 5 cm per year beginning at age 1+ at 9 cm (Fig. 6).

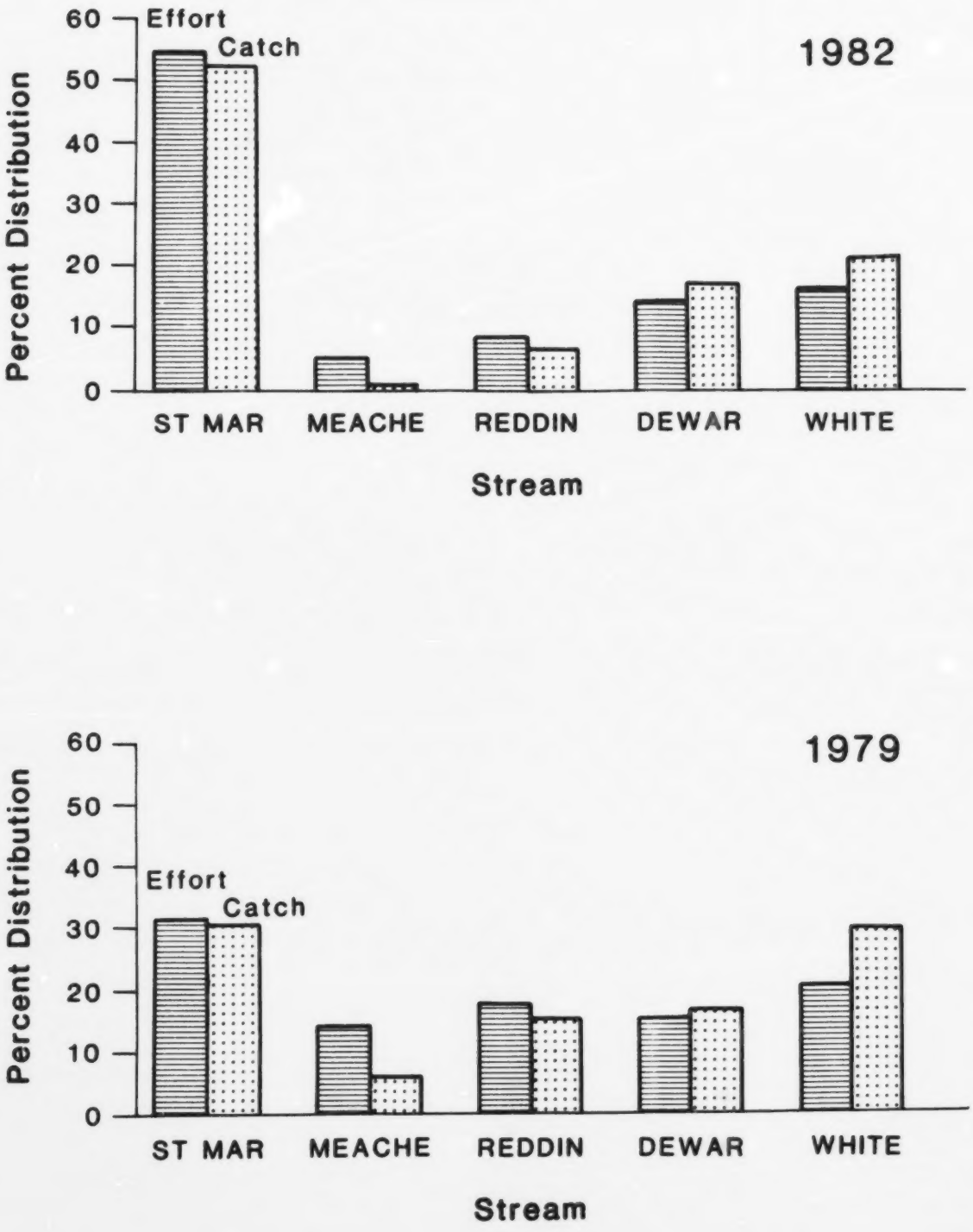

Fig. 4. Percent angling effort and catch by drainage in the Upper St. Mary River watershed.

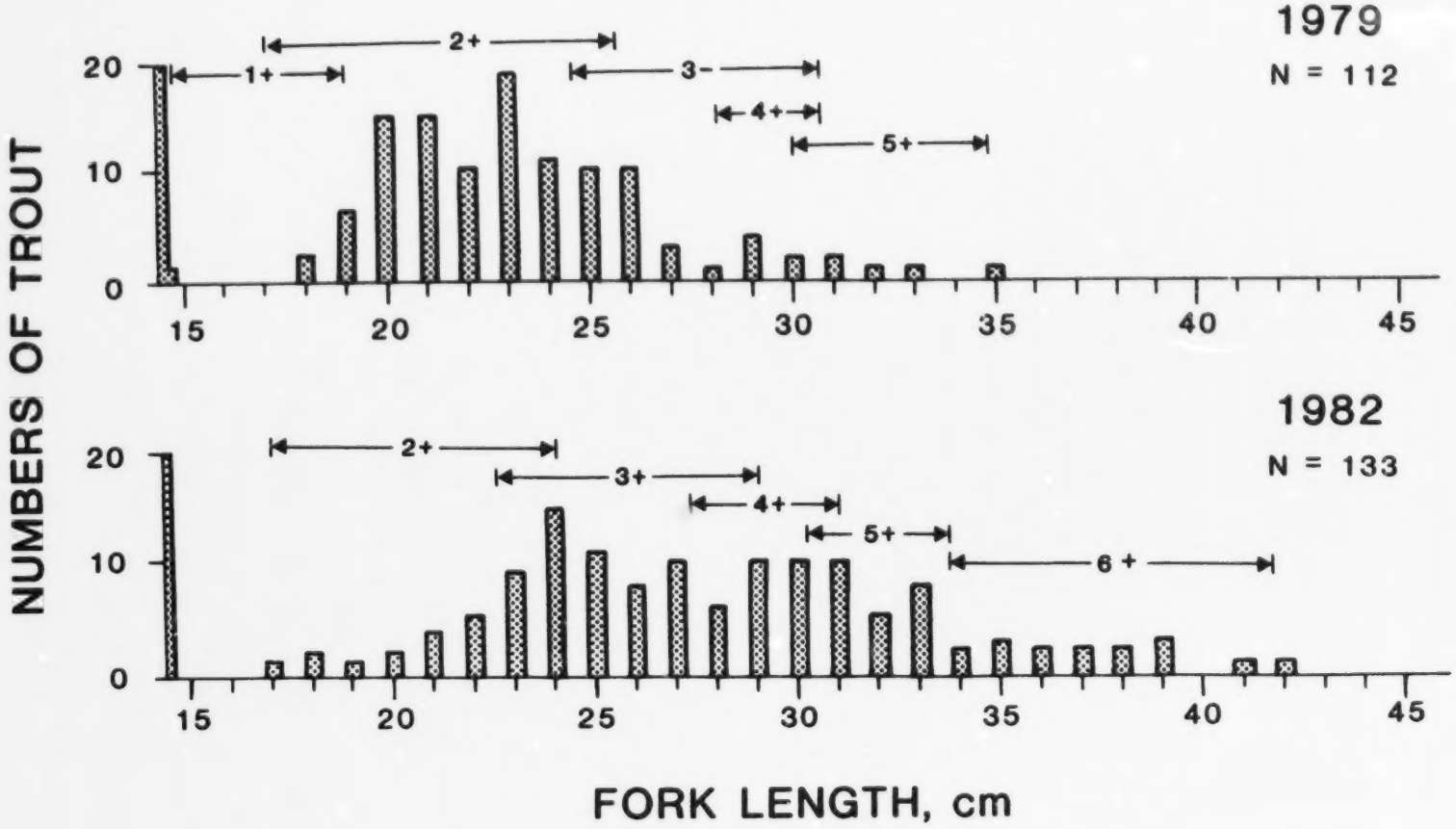

Fig. 5. Length frequency and age distributions of cutthroat trout angled in the Upper St. Mary River watershed prior and following a 2.5 year angling closure.

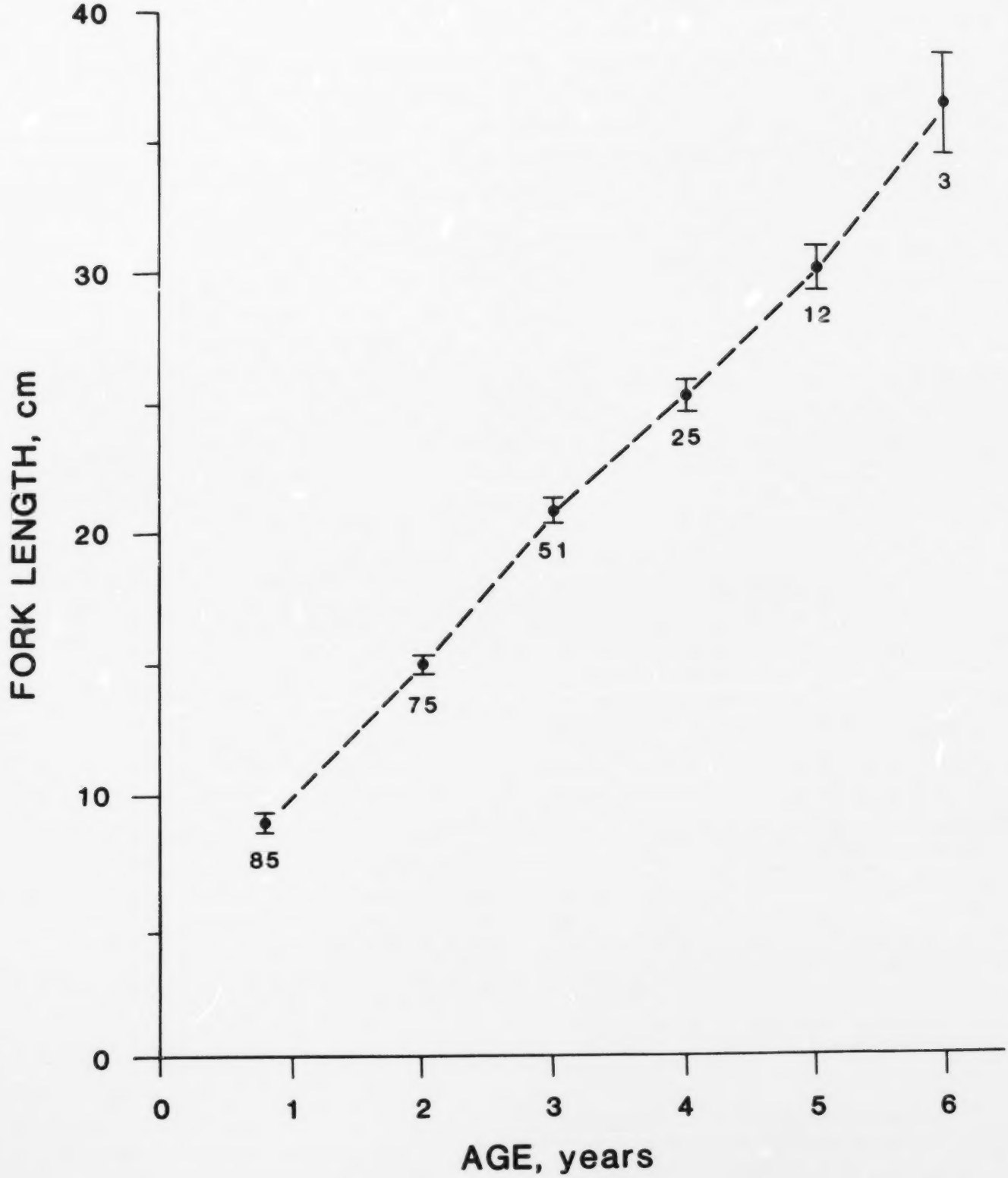

Fig. 6. Mean back-calculated fork lengths (± 1 S.E.) of cutthroat trout angled in the Upper St. Mary watershed.

Tagging

A total of nine tag returns (28.5%) from the St. Mary River fishery were reported in the fall of 1982. Six tag returns were confirmed by tag number and location of recapture. Recapture locations of all fish were in the area of original marking. One tag was returned from the fishery during the summer of 1983.

DISCUSSION

Baily and Nessman (1982) found that outdoor recreation was the major recreational activity in the East Kootenay area. Of those persons who participated in outdoor recreation, 77% fished. Access to watersheds such as the upper St. Mary River and their outdoor recreational values are important to residents of the area. The fall use of the upper St. Mary watershed is considerable given the population of the Cranbrook-Kimberley area and numerous alternative recreation sites. The use estimate of 6500 days of recreation by 5400 people is probably greater than would have occurred if there had been no stream opening, however, in the fall, angling accounted for only 25% of recreational use. The increase in use attributed to the fishery opening is probably in the order of 15%. Angling activity was concentrated in the first two weeks of September; thereafter angling activity decreased despite relatively high success rates.

In the sport fishery, direct comparison of effort and catch before and after the closure was not possible owing to differences in census seasons. Catch success rates and the proportion of catch released before and after the closure were similar. However, the spatial distribution of anglers and catch within the watershed and the size and age composition of the catch changed dramatically. Mean size in 1979 was 23 cm compared to 29 cm in 1982. Further, mean age was 2+ in 1979, but 3+ in 1982.

Seasonal variations in angling success rates probably mask the differences in abundance of cutthroat trout before and after the closure. The differences in abundance between 1979 and 1982 would result from an elimination of angling mortality. These differences may be small compared to the potentially large increases in abundance of trout recruiting in 1984-85 to the fishery due to increased spawning escapement resulting from the closure.

Prior to the closure in 1979, anglers concentrated on the more accessible reaches of the upper tributaries because the lower reaches of the system were probably "fished out". Following the closure, the distribution of anglers and cutthroat caught shifted back to the mainstem St. Mary (including its upper reaches) in response to increased abundance and fish size.

The relatively low fishing effort that occurred on the

mainstem St. Mary River yielded a 25% tag return rate for marked fish. If post-hooking (tagging) mortality, tag loss and non-return of tags are considered, angling mortality for catchable cutthroat trout on the lower river may be in the order of 50-60%. At this rate of exploitation the gains in the numbers of catchable size fish realized from a 2.5 year closure on the St. Mary watershed were of limited duration.

Rotational or alternate year closures have been shown to be effective in maintaining cutthroat trout populations in Alberta's east slope streams (Radford 1975 MS; 1977 MS). The Alberta management program is based on the premise that (1) the perennial harvest of catchable sized cutthroat trout (> 15 cm in length) is a product of a previous closed season; (2) a high percentage of mature female cutthroat trout are harvested during the open season (thereby necessitating a subsequent closed season to ensure an adequate amount of natural reproduction).

Rotational closures are attractive because of their simplicity in administration and enforcement; however, based on the results of this study they are not recommended as a management strategy for cutthroat streams in the East Kootenay for the following reasons:

1. Alternate year closures do not provide quality fisheries in terms of success rates or average size of fish because the fisheries are primarily dependent on one year class.

2. As angling effort increases, catchable fish are harvested in shorter time periods following the opening date, therefore functionally reducing the length of the angling season.

3. In any single year, half of the cutthroat streams in the East Kootenays would be closed. Effort would then be concentrated on a smaller number of streams leading to overcrowding.

4. Alternate year closures are a single species management scheme that ignores the fisheries potential or management requirements of other species, eg. Dolly Varden and mountain whitefish.

5. Alternate year closures are primarily applicable to consumptive fisheries. The levels of effort the stream supports is primarily governed by the number of catchable fish recruiting into the fishery. To maintain quality fisheries in East Kootenay streams where the demand currently exceeds supply (Andrusak and Brown, 1983 M.S.), either demand must be reduced or fisheries must become more non-consumptive (eg. size limits, released fish).

The 2.5 year closure on the St. Mary River watershed was effective in increasing the size and age distribution of

cutthroat trout. Although these gains were transitory in association with liberal regulations, they were effective in demonstrating to the angling public that streams similar to the St. Mary River were capable of producing quality fish. Further, the closure and opening suggested that there is a significant risk that the stream could be "fished out" rapidly under moderately liberal (4 fish/day, no size limit) regulations. Experience gained from the St. Mary fishery has established the basis for more intensive and restrictive management of streams in the East Kootenay.

Further regulations of the St. Mary River should be designed to maintain quality stream fisheries, coinciding with high levels of effort, by encouraging non-consumptive fisheries but at the same time allowing a certain proportion of the catch to be retained through the use of size limits and restrictive quotas (Slaney et al 1984 M.S.). Retaining fish caught is one of the major, but not the only important factor in stream angling and should be maintained unless angling effort becomes excessive.

The application of size limits, gear restrictions, reduced quotas and seasonal closures to maintain a viable cutthroat fishery at current and expected levels of effort should be examined in detail on a stream specific and species specific basis. The use of closures to rehabilitate stream stocks prior to implementation of special regulations is recommended because angler compliance rates to restrictive harvest quotas and size limits are probably higher if there are large fish in the stream system.

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Appendix 1. Survey form used in recreational survey of the St. Mary River Watershed, September - October 1982.

GENERAL QUESTIONNAIRE

1. What River Drainage? _____ km. _____
2. Day Use? ☐
   Overnight? ☐ No. Nights? _____
3. Residence Status:
   - East Kootenay ☐ No. of Persons _____
   - Other B. C. ☐
   - Alberta ☐
   - Other Canadian ☐
   - United States ☐
   - Other ☐
4. Activity
   - Fishing ☐
   - Hunting ☐
   - Touring ☐ 4 X 4 ☐ Dirt Bike ☐
   - Canoeing ☐
   - Hiking ☐
   - Berry Picking ☐
   - Wood Cutting ☐
   - Horseback ☐
   - Other ☐

ANGLING QUESTIONNAIRE

1. No. Anglers? _____
2. No. Hours? _____
3. Species? _____

#	Length	Weight	#	Length	Weight
1			6		
2			7		
3			8		
4			9		
5			10		

HUNTING SURVEY

1. No. Hunters? _____
2. No. Days? _____
3. Species? _____
4. No. Kills? _____

Appendix 2. Recreational activities undertaken in the St. Mary Watershed, September - October 1982.

SEPTEMBER

Activity	weekday(3)		weekday(7)		Saturday(11)		Sunday(19)		weekday(24)		Monday(27)	
	n	%	n	%	n	%	n	%	n	%	n	%
Fishing	99	63.5	31	47.4	34	23.5	67	21.1	4	20.0	4	10.5
Hunting	-	-	-	-	55	37.6	82	26.1	10	40.0	13	36.8
Touring	12	7.9	7	10.5	3	2.4	63	19.9	4	20.0	-	-
Berrypicking	27	17.5	15	23.7	9	5.9	10	3.1	-	-	-	-
Woodcutting	15	9.5	12	18.4	45	30.6	72	23.0	4	20.0	11	31.6
Canoeing	-	-	-	-	-	-	4	1.2	-	-	-	-
Horseback	-	-	-	-	-	-	2	0.6	-	-	-	-
Other	3	1.6	-	-	-	-	16	5.0	-	-	8	21.1
TOTAL	156	100.0	65	100.0	146	100.0	316	100.0	22	100.0	36	100.0

OCTOBER

Activity	Saturday(2)		weekday(14)		Sunday(17)		Monday(25)		weekday(26)		weekday(27)	
	n	%	n	%	n	%	n	%	n	%	n	%
Fishing	9	6.8	4	18.8	4	2.7	1	7.1	1	7.7	3	8.7
Hunting	56	40.5	7	37.5	83	57.6	9	42.9	12	69.2	27	73.9
Touring	8	5.4	-	-	11	8.2	3	14.3	1	7.7	2	4.3
Woodcutting	64	45.9	9	43.7	28	19.2	7	28.6	3	15.4	5	13.1
Other	2	1.4	-	-	18	12.3	1	7.1	-	-	-	-
TOTAL	139	100.0	20	100.0	144	100.0	21	100.0	17	100.0	37	100.0

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